UNIVERSITI PUTRA MALAYSIA

A RETROSPECTIVE STUDY OF ORAL FRACTURES IN CATS AND DOGS PRESENTED TO UNIVERSITI VETERINARY HOSPITAL (UVH) FROM 2010 TO 2013

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A RETROSPECTIVE STUDY OF ORAL FRACTURES IN CATS AND DOGS PRESENTED TO UNIVERSITI VETERINARY HOSPITAL (UVH) FROM 2010 TO 2013.

BY

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It is hereby certified that we have read this project paper entitled "A retrospective study of oral fractures in cats and dogs presented to Universiti Veterinary Hospital (UVH) from 2010 to 2013, by Teh Ai Ling and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999 - Project.

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KAJIAN RETROSPEKTIF FRAKTUR MULUT DALAM KUCING DAN ANJING YANG DIPERSEMBAHKAN DI UNIVERSITI VETERINARY HOSPITAL DARI TAHUN 2010 HINGGA 2013

TEH AI LING

MARCH 2015

PENYELIA: DR. ROZANALIZA RADZI

PENYELIA BERSAMA: DR. LAU SENG FONG

Rekod perubatan dan radiograf untuk anjing dan kucing yang telah didiagnosis dengan fraktur mulut di Universiti Hospital Veterinar, Universiti Putra Malaysia antara 2010-2013 telah dikaji semula secara retrospektif. 137 fraktur kes oral dalam 88 kucing dan empat anjing telah dikenal pasti dalam kajian ini. Signalment pesakit, tanda-tanda

klinikal, jenis trauma, lokasi fraktur, jenis-jenis fraktur, pilihan rawatan, komplikasi diperhatikan dan tindak balas. Lokasi paling biasa fraktur oral dalam kedua-dua kucing (24%) dan anjing (50%) adalah fraktur tulang rahang. Fraktur rahang lengkap dan melintang adalah yang paling biasa berlaku dalam kucing (65%). Tetapi pada anjing 50% adalah fraktur rahang lengkap dan serong. Sebahagian besar kes telah dibawa masuk kerana kucing kemalangan jalan raya (59%) dan pada anjing (50%). Kebanyakan kes-kes yang dikemukakan dengan fraktur lokasi tunggal (72%). Fraktur yang paling biasa ialah luksasi temporomandibular persimpangan dan fraktur tulang rahang (dua lokasi), dan pemisahan symphyseal rahang, luksasi bersama temporomandibular dan fraktur tulang zygomatic arch (tiga lokasi yang berbeza). Majoriti kucing (46%) telah melalui pembedahan berbanding dengan anjing (50%) yang telah stabilkan dengan rawatan konvensional. Pendekatan pembedahan yang paling biasa adalah cerclage pembaikan wayar (62%) di kedua-dua kucing dan anjing. Kebanyakan kes-kes yang distabilkan melalui pembedahan mempunyai malocclusion (42%). Majoriti kes yang distabilkan pembedahan telah bertindak balas dengan baik (50%). Walau bagaimanapun, terdapat kes-kes yang distabilkan melalui pembedahan (79%) tetapi meninggal dunia sama ada sebelum pembedahan disebabkan oleh trauma yang teruk atau selepas pembedahan kerana komplikasi lain.

Kata kekunci: Fraktur oral, luksasi temporomandibular persimpangan, pemisahan symphyseal rahang dan cerclage wayar.

ABSTRACT

An abstract of the project paper presented to faculty of veterinary medicine in partial fulfillment of the course VPD 4999 – Project

A RETROSPECTIVE STUDY OF ORAL FRACTURES IN CATS AND DOGS PRESENTED TO UNIVERSITI VETERINARY HOSPITAL (UVH) FROM 2010 TO 2013.

TEH AI LING

MARCH 2015

Supervisor: Dr. Rozanaliza Radzi

Co-supervisor: Dr. Lau Seng Fong

The medical records and radiograph for dogs and cats that had been diagnosed with oral fractures at Universiti of Veterinary Hospital, Universiti Putra Malaysia between 2010 to 2013 were reviewed retrospectively. 137 of oral fractures cases in 88 cats and four dogs were identified in this study. Patient signalment, clinical signs, types

of trauma, locations of fracture, types of fractures, treatment options and complication were noted. The most common locations of oral fracture in both cats (24%) and dogs (50%) were mandibular fractures. A complete and transverse mandibular fracture was the most common fractures type in cats (65%). But in dogs 50% was complete and oblique mandibular fracture. Majority of the cases were brought in due to road traffic accident cats (59%) and in dogs (50%). Most of cases presented with single location fractures (72%). The most common multiple fractures were temporomandibular junction luxation and mandibular fractures (two locations), and mandibular symphysis separation, temporomandibular joint luxation and zygomatic arch fractures (three different locations). Majority of cats (46%) were surgically stabilized compare to dogs (50%) which were stabilized with conventional treatment. The most common surgical approach was cerclage wire repair (62%) in both cats and dogs. Most of cases stabilized surgically has malocclusion (42%). Majority cases stabilized surgically were responded well (50%). However, there were cases stabilized surgically (79%) but died either before the surgery due to severe trauma or after the surgery due to other complication.

Keyword: Oral fractures, temporomandibular joint luxation, mandibular symphysis separation, cerclage wire

1.0 Introduction

Skull or also known as entire head skeleton, is casing to enclose the brain and sensory organs (de Lahunta, 2013). One of important part in skull which is more related to this study is oral skeletons. It consists of maxilla (upper jaw), mandible (lower jaw), temporal bone, and zygomatic bone.

Maxilla is consisting of friable bone which forms a firm structure. It consists of incisive, maxilla and palatine bone (Bojrab et al., 1990). Incisive is the region where it contains six incisor teeth, maxilla the largest bone of face consists of all the cheek teeth. The palatine bone forms the caudal part of hard palate and cranial wall of pterygopalatine fossa. Mandible which consists of left and right part is connected by a fibrous joint. Each part of mandible consist of mandibular body (bear incisor teeth and molar teeth) and ramus (non-tooth bearing part, consist of coronoid, condyloid and angular process). Zygomatic bone which rostrally articulate with maxilla and caudally forms a long suture with zygomatic process of temporal bone, and forms rostral half of the zygomatic arch. The zygomatic process of temporal bone exceed the zygomatic bone rostrolaterally and forming zygomatic arch. The ventral base of zygomatic process formed mandibular fossa which articulates with mandibular condylar to form temporomandibular junction (de Lahunta, 2013).

Muscle associated with oral cavity play a major role for the oral structure to function as a whole. The five main muscles of mastication are masseter, medial

pterygoid, lateral pterygoid, temporalis and digastrics muscle. Opening of mandible is assisted by digastrics muscle and closing of mandible by masseter, medial and lateral pterygoid muscles.

Fracture is defined as dissolution of bony continuity with or without displacement of fragments. It is caused by two main factors; extrinsic and intrinsic factors. Extrinsic factor consists of direct violence and indirect violence such as bending forces, torsional forces, compressional forces and shearing forces. Intrinsic factor consists of muscular actions and pathological condition. These two main factors influence the occurrence of fracture of bones (Nunamaker *et al*., 1985). Mandibular fracture was reported to be more common types of fractures in dogs (Fernanda *et al*., 2005). He reported incidence of maxilla fracture is low compare to mandible. This is due to anatomical influence where the maxilla is more resistant to fracture with line of debility and resistance (Haskell *et al*., 1994). Kitshoff *et al*., 2013 reported least incidence of fracture at condylar region due to protective effect of masticatory muscles.

Trauma is reported to be the main cause of oral fracture etiology (Fernanda *et al*., 2005). Trauma can be road traffic accident, high rise syndrome, fighting, violence, gunshot and etc. other pathological condition such as oral neoplasia, periodontitis and iatrogenic can contributed to oral fractures. The alveolar bone resorption following periodontitis reduce the bone integrity and strength and consequently lead to fractures.

D.vnuk reported the common clinical signs shown in high rise syndrome are epistaxis, hard palate fractures, limb fractures as well as thoracic trauma. During fall, cats were instinctively extended their limbs and therefore the impact is at the limb. However, when the maximum velocity is achieved, the vestibular system is no longer stimulated and the cats extend their limb horizontally and cause injury on head or thoracic region. Other clinical signs such as deviated mandible, mouth bleeding, pain and crepitus upon palpation are related to mandibular fractures. Inability to close mouth is related to temporomandibular joint luxation. Swelling of periorbital region is related to zygomatic arch fractures (Scott *et al*., 2007).

Surgical approaches are one of the treatment options for oral fracture. The techniques consist of circumferential wiring, acrylic splints, percutaneous skeleton fixation, bone plating and partial mandibulectomy. Tape muzzle as a non-surgical treatment provide temporary stabilization for jaw fracture. It is indicated in young animal due to its rapid healing potential as well as to avoid disruption of tooth and skeletal development (Milella., 2015). Circumferential wiring is indicated for symphyseal fractures and acrylic splints for fracture rostral to first molar. Mostly comminuted fractures can be repair by using percutaneous skeletal fixation. Bone plate provides a rigid stabilization but malocclusion is possible after fixation due to error in reduction. Extensive trauma or infection is repaired by using partial mandibulectomy (Marreta., 1998).

1.1 Justification

Few studies were done on the review and comparison of common oral fractures and surgical repair in cats and dogs, the complication that arises from these cases and progression of the patient several years after the treatments. Thus my study will focus on retrospective study of oral fractures in cats and dogs for a four year period from the year 2010 till 2013. The information gathered from the study will be useful for the veterinarians in treatment and prognosis in cats and dogs with oral fractures.

1.2 Objectives of study

The aims of my study are to:

1. Identification and classification of common types of oral fracture in dogs and cats
2. To review the surgical and non-surgical treatment approaches.
3. To determine the complication that arises after the fixation of oral fractures in dogs and cats.

2.0 Literature Review

2.1 Etiologies of oral fractures

In young cats, the most common fracture etiologies are hit by car, high rise syndrome, fighting, and dog bite (Nicholas *et al*., 2013). This is concurrent with the evidence of inexperience and roaming younger cats are more susceptible to potential dangerous situations compared to adult cats. (Umphlet *et al*., 1988). Fernanda has also reported in 2005 that the most common etiologies involved in oral fracture in dogs were (43%) dog bites and (12%) due to automobile trauma. The incidence of oral fractures in adult dog increases due to advanced periodontal diseases following activities that lead to fractures such as chewing bones or foods, and routine activities.

Other pathological conditions that are predisposing the animal to oral fracture are neoplasia and metabolic abnormalities (Amalia *et al*., 2013).

2.2 Types of fractures and location

Fractures following trauma are due to several factors. The degree of force which directly towards the head, the resistance of facial bones towards those force, point of impact, types of injury as well as function of muscle at related location. In a retrospective study done by Fernada *et al*., 2005, the most common location of fractures were mandible fracture (90%) and least location were at maxilla (10%). The differences of fracture occurrence involving these two locations were due to bone resistant

properties of maxillary region and lines of debility in mandible. In the similar study, molar region (85.9%) and canine region (67.5%) was the region with highest incidence of fracture. canine region commonly involved in this study due to frontal force by vehicular trauma and the molar region has highest incidence due to bite wound injury and prehensile forces.

In a retrospective study of mandibular fractures done by Kitshoff *et al*., 2013, the highest mandibular fractures were at molar region (41.48%), followed by premolar region (19.26%) and the least occurrence at condylar region (1.48%). Advanced periodontitis disease contributed to weakening of alveolar and periodontal ligament that cause fractures in the molar region. Condylar region is well protected by the masticatory muscle and the minimum movement in the joint enables this region to absorb the forces, thus allows least injuries and least fracture at this region. Mandibular symphysis region is at the high risk for fracture because it consists of fibrocartilage which has least capability to absorb forces. In the similar retrospective study, the fractures were classified into transverse, short oblique, oblique, comminute and incomplete. The study also showed highest incidence at molar and premolar regions with short oblique fractures, while the symphysis region with transverse and ramus region with incomplete fracture which might due to the protective effect masticatory muscle.

A restropective study of mandibular fracture by Umphlet et al., 1988, the highest incidence was at mandibular symphysis region (73.3%) which probably due to forces directed at jaw to rostral midline during high rise syndrome as well as the property of

synarthrosis that easily to be separated. Mandibular body was the second highest (16%) due to extreme external forces on caudal to symphysis that resulted in fracture. Both condylar and coronoid were the least mandibular fractures sites as these two sites were protected by the zygomatic arch and masseter muscles. In this study, fractures are classified into open and close type of fractures. The sharp and angular edges of mandible fracture as well as thin separation of mandible caused open fractures. The extreme external forces to lesser muscle region on mandibular region caused open fracture as well.

Diagnosis of oral fractures can be made based on detailed physical examination and confirmative diagnosis from radiograph. A radiograph with different views (ventrodorsal or dorsoventral, laterolateral or oblique) is needed. In a study done by Bar-am *et al*., 2008, the most difficult anatomical structure to identify by radiographic images were maxillary midline, horizontal midline of palatine bone, vomer bone, nasomaxillary suture, sphenoid bone and pterygoid bone. There is difficulty in interpreting and make a diagnosis from a radiograph due to superimposition as well as overlapping shadows. Computed tomography is alternative diagnostic tools. It enables the exact anatomical identification, shorten the period of anaesthesia and able to identify extend of bone displacement.

2.3 Treatment option

Nicholas *et al*., 2013, has categorized surgical approach as a treatment option based on location of fracture involved. In uncomplicated symphysis fracture, cerclage

wire repair is versatile method with the average clinical union period of 6 weeks. For mandibular body fracture, there are variety of surgical approach available; interarcuate stabilization, interfragmentary wiring, external fixation and mini-plate and screws application. Interarcuate stabilization is done by using maxillary-mandibular wiring method or dental acrylic or transarticular external skeletal fixation placement. The interfragmentary wiring method is indicated for simple, unilateral, oblique fractures where the healing took place for 4-6weeks. However it is not suggested for bilateral body fractures and comminuted fractures. External skeletal fixation is indicated for comminuted fractures as well as difficulty in fracture fixation due to soft tissue wound. The average clinical union is 5.5 weeks and the cats responded well towards this approach. Application of titanium mini-plate and screws fixation at tension aspect mandible which avoid the mandibular canal, has healing period of 6-9 weeks. In more severe cases where stabilization is not possible or the fracture was failed to heal after the attempt, mandibulectomy is indicated. More caudal region of mandible which makes internal fixation difficult, conservative treatment is indicated. Temporomandibular joint luxation or fracture can be stabilized by using closed reduction.

In a study done by Umphlet *et al*., 1988, cases with condyloid fractures were not stabilized by primary internal fixation. However, it indirectly stabilized by using cerclage wire at symphysis fracture because condyloid is difficult to be expose surgically due to its smaller size and protected location. Cases of coronoid process fractures were stabilized indirectly by using wiring between maxillary and mandibulary region as this cause limited movement of the affected sites. In the similar study,

antimicrobial therapy is suggested as well. Administration of antibiotic aid in reduction of infection of the soft tissue at affected site as well as prevent invasion of bacteria into the fracture site.

Sandra *et al*., 1998 has stated tape muzzle as one of the temporary fixation method before a definitive repair is performed. However, it can be primary fixation method in a mild displaced fracture of mandibular ramus especially in young animal as the healing occurs more rapidly. Internal fixation by using bone plate allows rapid healing process with little or no callus formation. However, placement of the plate is difficult where it can traumatize the tooth root or neurovascular structures. Smaller size of miniplate can be use as this prevent trauma to toot root because the placement is close to the alveolar border.

2.4 Complication

In the study of mandibular fracture, Umphalet *et al*., 1988 stated the most common complication arises were malocclusion, soft tissue swelling, loss of teeth, and avulsion of osseous structures. Soft tissue swelling was the second highest due to presence of bacteria in the oral cavity as well as unhygienic condition of oral cavity predispose to infection. Mandibular symphysis has the least complication as this area has excellent supply of blood as well as local resistance towards infection. Cases with multiple fractures have higher complication rate due to extensive trauma to both soft tissue and bones. Complication arises when there is disruption in alveolar blood supply and rendered reduction and fixation difficult. There were cases of malocclusion in

condylar fracture as there was no fixation was done at this site. Few cases of temporomandibular joint fractures with degenerative joint disease identified due to resilient fibrocartilage of the articular surface.

Diseased teeth at fracture site can lead to other complication such as osteomyelitis and bone sequestration. (Sandra *et al*., 1998). This is concurrent with the delayed and non-union fracture sites. Malocclusion is most common complication observed and this can be prevent by immediate removal of fixation tools together with proper reduction method applied. Extractions of maloccluded teeth allow closure of the mouth in a poorly fixed fracture sites.

3.0 Materials and Methods

The radiological log book from radiological unit in University Veterinary Hospital (UVH) of University Putra Malaysia between January 2010 to December 2013 for both cats and dogs with oral fractures were reviewed. The patient medical records of the related cases were retrieved and reviewed. Patient with oral fractures that were euthanized in front office or after warded were included in this study as well. The data collected from the records included patient signalment, types of trauma, location of fractures, types of fractures, methods of treatment, types of surgical approach, complication arise after the fracture fixation, and response to the treatments. Locations of fractures as well as types of fractures were noted by reviewing the radiograph of the related cases.

The age and sex of the patient were recorded. These patients were categorized ages of below 12 months as junior cats or junior dogs and above 12 months as adult cats or adult dogs. The breeds of patients related to this study were recorded as well. From the patient medical records, the types of trauma, types of treatments, surgical approaches, complication arise as well as the respond towards the treatment were recorded. Types of trauma were grouped into few categories; hit by car, high rise syndrome, unknown and others (dog bites injuries, fighting, and hit by forklift). Types of treatment were grouped into surgical treatment, non-surgical treatment, no treatment or animal were put to sleep. Surgical approaches were based on the records of patients stabilized surgically by cerclage wire repair, dental extraction, cerclage wire repair and tape muzzle, cerclage wire repair and dental extraction, cerclage wire repair and closed

reduction, maxillectomy, external skeletal fixation type 1 and dental extraction, external skeletal fixation and cerclage wire repair together with dental extraction or external skeletal fixation type 2 alone. Complication arises were collected based on after surgery and there were unable open mouth completely, suture breakdown, movable mandible, malocclusion, mandible misalignment and unable close mouth. Respond toward treatment were good, poor or died before the surgery or after the surgery.

The next part of my studies would be to diagnose each radiograph on location and types of fractures. The fractures locations within radiograph were then classified into temporomandibular junction luxation, maxillary fractures, mandibular fractures, and zygomatic arch fractures. The sites of mandibular and maxillary fractures were then more specified. The mandibular fracture consist of mandibular symphysis separation, fracture at canine region, premolar region, molar region, ramus region and condylar region. The maxillary fracture was then specified into fracture at incisive and nasal septum separation. Types of fractures were categorized as transverse and complete, oblique and complete, comminuted and complete, transverse and incomplete, oblique and incomplete as well as comminuted and incomplete fractures.

4.0 Statistics

For this study, comparison between species, sex, age group, breeds and types of trauma frequencies of clinical signs, location of fractures, types of fractures, treatment approach, surgical approach, complication after surgery and response to treatment was conducted using Mann-Whitney and Kruskal-Wallis tests, All analyses were done using SPSS version 20 and the overall statistical significance was set at $p<0.05$.

5.0 Result

A total of 133 cases of cats and four dogs which met the criteria of this research objectives were used in this retrospective study. In the feline group, there were 115 Domestic Short Hair (DSH) cat and 18 cats were categorized as other breeds. In the canine group, there were one Mongrel, one Rottweiler, one Local and one Shih Tzu breeds. The mean age of occurrence of fractures for cats was 27.9 months and for dogs was 41.0 months.

There was significant difference between canine and feline species ($P=0.029$) on the locations of fracture but showed no significant difference on clinical signs, types of fractures ,treatment approach, surgical approach, complication after surgery and response to treatment. There were 55% intact male, 45% female, 4% castrated male and 7% spayed female cats. There were 75% intact male and 25% intact female dogs. There

was no significant difference between sex and the location of fractures and types of fractures. However there was significant difference between sex groups on response towards treatment approach.

Cats aged less than 12 months old were categorized as junior cats (41%) and older cats aged more than 12 months as adult cats (55%). Both age groups showed no significant difference on the location of fractures, types of fractures, clinical signs, treatment approach, surgical approach, complication of surgery and response to treatment. Dogs aged less than 12 months old categorized as junior dogs (25%), and dogs aged more than 12 months old as adult (75%). Both age groups showed no significant difference on location of fractures, types of fractures, clinical signs, treatments approach, surgical approach, complication of surgery and response to treatment as well.

In addition to that, breed groups in both canine and feline groups showed no significant difference on most common sites of fracture; mandibular fracture (24% in cats) and (50% in dogs). There was no significant difference among breeds on the common types of fractures; complete transverse fractures in cats (20%) and complete oblique fracture in dogs (50%).

Types of trauma involved in the feline group were road traffic accidents (59%), high rise syndrome (11%), unknown cause (23%) and others (8%). In the canine group, most of the traumas were road traffic accident (50%), and unknown cause (50%) Both

canine and feline groups showed no significant difference among types of trauma and locations of fractures as well as types of fractures.

Most of the 110 cases presented with clinical signs were of deviated mandible (17%), followed by epistaxis (16%) and unable to close mouth (15%). There were other clinical signs observed as well; open mouth breathing (12%), cleft palate (10%), nasal discharge (7%), abdominal breathing (5%), halitosis (6%), mouth bleeding (5%), hyphema (3%), pain upon open mouth (2%) and hypersalivation (3%).

Mandibular fractures was the most common location of fractures in cats (47%) and dogs (50%). There were (23%) cases of mandibular symphysis separation, 3% mandibular body fracture, 2% ramus fracture, 2% molar fracture and 1% condylar fracture in cats which were not identified in dogs. There were (21%) cases of temporomandibular junction luxation in cats; however it was not identified in dogs. 15% fracture at mandibular canine region in cats and 25% in dogs. 2% of fracture at mandibular premolar region in cats and 25% in dogs. The other fracture identified was zygomatic arch fracture 14% in cats of which 48% were of common oblique and complete fracture which was not identified in dogs. There were significant difference between location of fracture and types of fracture ($P<0.05$). There were common transverse and complete mandibular fracture (65%) and 50% cases of oblique and complete mandibular fracture in dogs. There were 11% cases of separation of nasal septum in cats and 25% in dogs. There was 5% of maxillary fracture at incisor region in

cats of which 15% were of transverse and complete fractures as well as 25% cases of maxillary fractures in dogs of which 50% were of oblique complete fractures.

There were 22% of single patient with two different fracture locations of fractures and 7% of three different fracture locations as in both species. Mostly 72% single patient presented with single case of fracture location. The most common two locations of fractures in a single patient were temporomandibular joint luxation and mandibular fractures. Whereas, three types of fractures location were mandibular symphysis separation, temporomandibular luxation and zygomatic arch luxation.

There were 46% cases treated with surgical method, 32% treated with non-surgical method, 14% no treatment and 8% were cases put to sleep in cats group. There were 25% treated with surgical method, 50% treated with non-surgical method and 25% no treatment in dogs group. Both canine and feline groups showed no significant difference between locations of fracture and treatment approach. The most common surgical approach was cerclage wire repair (62%) and there were no significant difference between locations of fractures and surgical approach. But showed significant difference between treatment approach and surgical approach ($P<0.05$).

The most common complications arise after surgery were unable to close the mouth (37%), malocclusion (42%) and suture breakdown (21%), There were significant difference between surgical approach ($P=0.01$) and treatment ($P<0.05$). However there was no significant difference between locations of fracture and complication of surgery

in both canine and feline group. There were no significant difference between age groups and complications of surgery as well.

In addition to that, there were significant relationship ($P<0.05$) between treatment approach and response. Majority of cats received surgical treatment responded well (50%) and those received non-surgical treatment (37%) responded well. Cats responded poorly (54%) after the surgical treatment and cats (79%) died after the surgery.

6.0 Discussions

Oral fractures are relatively common in cats than dogs and it showed a significant difference on the locations of fractures. This can be related to the strength of the skull as proved by Slatter's study of allometry and performance that the skull strength increases with increasing felid size. This study was performed to compare the strength and performance in the felid group. However, further study need to be carry out to identify association of occurrence of fracture in different location and species (especially cats and dogs).

It is noted that intact male has largest proportion in occurrence of oral fractures compared to intact female. The predominance of intact male is possibly due to aggressiveness and free roaming activity that increase the incidence of traumatic injury (Fernanda *et al*., 2005). Mulherin *et al*., 2014 reported in his retrospective study, occurrence of maxillofacial injuries was common in male dog and this probably due to male dogs are more aggressive as well the hormonal effect on behavior patterns. In a study done by Neilson *et al*., 1989 castration able to reduce the incidence of urine marking, mounting, and roaming by 90% in dogs.

Young animal are more predispose to fracture as they are inexperience and expose to potentially dangerous situation such as road traffic accident, fighting and dog bite injury (Umphlet *et al*., 1988). In a retrospective study by Kitshoff *et al*., 2013, young dogs (57%) were related to mandibular fractures due to bone density and mineral content increases as the animal growing. Therefore, adult are less to be affected

compared to young dogs. However, in my study adult animal (58%) were more common to oral fractures compare to young animal (42%). This possibly due to most of young animal was keep indoor by the owners. In a human study of fractures of facial skeleton in children (Anderson, 1995), occurrence of fracture at facial skeleton was uncommon due to smaller size of the face and elasticity of the bone. The fibrocartilaginous plate stretch and becoming flaccid, hence increases the mobility of symphysis over years (Hale, 2005)

From my study, road traffic accident was the common types of trauma in cats and dogs. This is consistent with study done by Umphlet *et al*., 1988 where the automobile trauma was the largest proportions followed by fights or high rise syndrome in cat. In contrary, Kitshoff *et al*., 2013 reported dog bite (62%) was the common etiology in his study. In a retrospective study by Mulherin *et al*., 2014 fighting (35.8%) was the most common fracture etiology followed by motor vehicles trauma.

In addition, most of cases presented and diagnosed as oral fractures showed signs of deviated mandible, unable to close mouth as well as epistaxis. This probably because when the animal falls from height, the head might hit the ground first instead of the limbs and this cause direct trauma to the head. In a study of high rise syndrome (Vnuk *et al*., 2003), 8.4% of cats showed signs of epistaxis. In another study by Gatineau *et al*., 2008, most of cases involved in road traffic accident were presented with clinical signs of inability to open or close the mouth. There were other clinical signs shown by the animals as well such as nasal discharge, pain upon open the mouth,

mouth bleeding, abdominal breathing, halitosis, hypersalivation, open mouth breathing and hyphema. Animal might showed signs of open mouth, deviated mandible, hypersalivation and mouth bleeding in case of mandibular fracture. Whereas animal showed signs of epistaxis or open mouth breathing probably due to maxillofacial fractures. Pain upon open mouth or unable to close mouth might be due to temporomandibular joint luxated (Harry *et al*., 2007).

From my study, the most common location of fracture in cats (47%) and in dogs (50%) was mandibular fractures of which the common site in mandible was mandibular symphysis separation (23%) in cats. In previous study, the most common fractures were mandibular symphysis separation (73.3) as it is synarthrosis that easily separated when the jaw are exposed to rostral midline forces in high rise syndrome .Second most common location was mandibular fracture which due to high force directed causing fracture caudal to the symphysis (Umphlet *et al*, 1988). In a study of maxillofacial injuries in human (Subhashraj *et al*., 2007), the most common region of maxillofacial injuries was at mandibular region (30%). Mandible is mobile and less bony compared to maxilla; therefore it is more prone to fracture. The least common location of fractures was maxillary fractures (5%). This probably because maxilla more resistant to fracture with line of debility and resistance (Haskel *et al*., 1994). There is significant difference between location of fracture and types of fracture. Complete and transverse mandibular fractures were common in cats whereas complete and oblique mandibular fractures common in dogs. The fracture line is depending on the area of least resistance, for

example mandibular symphysis has the weakest joint and transverse fracture is most observed in this area (Kitshoff *et al*., 2013).

65 cases diagnosed with oral fractures were stabilized by surgical method and 38 were stabilized by non-surgical treatment. Surgical treatment was indicated for most of the cases possibly due to restore the normal occlusion and anatomical reduction of fracture as well as to stable the fracture. Umphlet *et al*., 1988 reported most of the cases were stabilized by surgical methods. Non-surgical treatment such as tape muzzle, close reduction, antimicrobial therapy, and wound cleaning were used. Tape muzzle may be indicated in young animal because of rapid healing potential as well to avoid further disruption of tooth and skeletal development (Amalia *et al*., 2013).

Stabilization of fractures using cerclage wire was the most applied methods. Probably due to the flexibility of the wire that makes it easier to use around the teeth. Mandibular symphysis separation is commonly and easily stabilized using the wire (Lengendre, 2005). The least method used was maxillectomy. This probably the methods used for severe cases of injuries that require removal part of the maxillar bone.

Umphalet *et al*., 1988 reported in his study that malocclusion was the most complication encountered. Probably due to presence of endotracheal tubes during mandibular fracture reduction that caused it difficult to assess the occlusion. In my study which is consistent with Umphalet's study, malocclusion was the common complication observed followed by unable close mouth and suture breakdown. Most of the caudal mandibular fracture caused compression of fracture segments which resulted the

mandible to deviated towards side of the fracture and hence cause malocclusion (Milella.L, 2013). There were significant difference between treatment and complication as well as between surgical approach and complication.

From my study, there were significant association between treatment and response towards it. 57% of the patients stabilized with surgical correction were responded well. This can be due to clinical union of the fracture site occurred and this able to stabilize the fracture as well as able to restore the normal function of oral cavity (open and close the mouth). 32% of the patients received non-surgical treatment responded well as well and this can be due to mild and stable fracture able to restore the normal function of the oral cavity.

7.0 Conclusion

From this study, I can conclude that 97% of oral fractures occur in cats and 3% in dogs. The common age of occurrence in cats was around 28 months and in dogs was around 41 months. There were significantly more cases of oral fracture in intact male cats (55%) and 75% in intact male dogs. There was significant difference between species group and locations of fractures.

Most of the cases presented to UVH had history of road traffic accident in both cats and dogs, followed by high rise syndrome in cats and unknown cause in dogs. Most of the cases showed signs of deviated mandible, unable close mouth and epistaxis. There was no significant difference among types of trauma on locations and types of fractures.

Mandibular fractures were the common location of occurrence. Mandibular symphysis separation and fracture at mandibular canine region was the most common site at mandible. The second highest was temporomandibular junction luxation. The least occurrence was tooth fracture. Complete transverse mandibular fractures was common in cats and complete oblique mandibular fractures was common in dogs. There was significant difference between locations of fracture and types of fractures.

Mostly the cases were stabilized by surgical approaches. Almost half of the surgically treated cases used cerclage wire repair technique. 32% treated with non-surgical treatment (tape muzzle, close reduction and antimicrobial therapy). There was significant difference between treatment option and surgical approaches.

Complication arises in patient after surgically treated were malocclusion, unable close mouth and suture breakdown. There were significant difference between surgical approaches and complication. 50% of the cats received surgical treatment responded well and 37% of cats received non-surgical treatment responded well. There was significant difference between treatment approaches and response.

8.0 Recommendation

As for my recommendation, I would like to suggest a better recording system by forming a log book with final diagnosis of the cases that are presented to both front office and cases that are warded. This will enable the future retrospective study to be more accurate. This would enable better identification of cases that are truly due to oral fractures. On top of that, a computing recording system will be better than manual recording and it enable easier way to access the cases.

I would like to suggest a radiological evaluation on criteria of temporomandibular junction luxation in future retrospective study. This will enable identification of various degree of luxation and the most common direction of luxation can occur.

I would like recommend future retrospective studies on oral fracture to be more specific on period of injury and complication arise regarding delay in fixation. I also would like to recommend more studies to be done on occurrence of oral fracture in canine and feline and the difference that contributing to it.

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10.0 Appendix

Figure 1.1: Bilateral zygomatic arch fracture

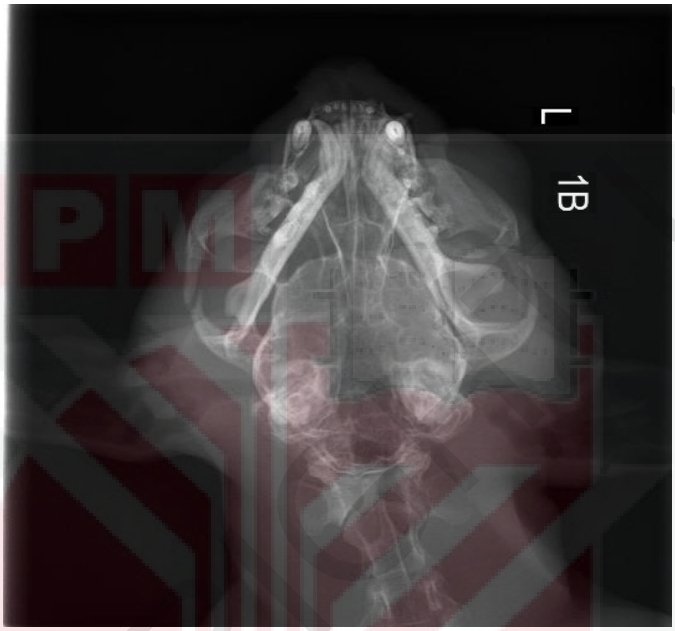

Figure 1.2: Mandibular symphysis separation

Figure 1.3: Mandibular fracture at canine region

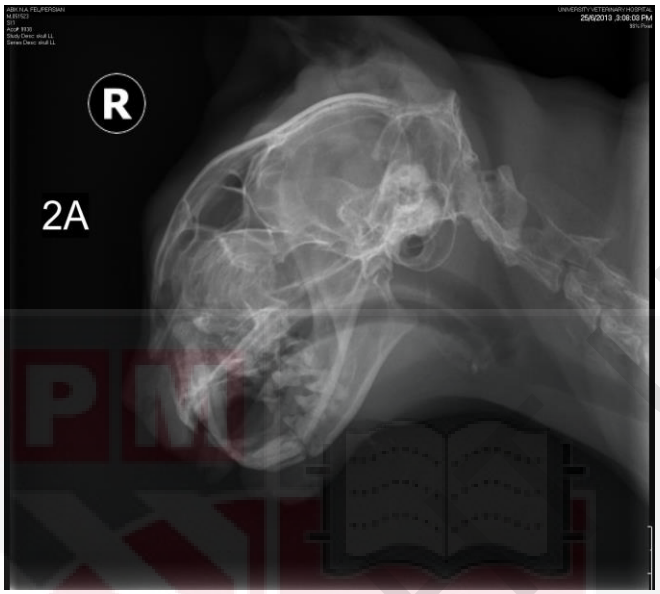

Figure 1.4: Mandibular fracture at ramus region

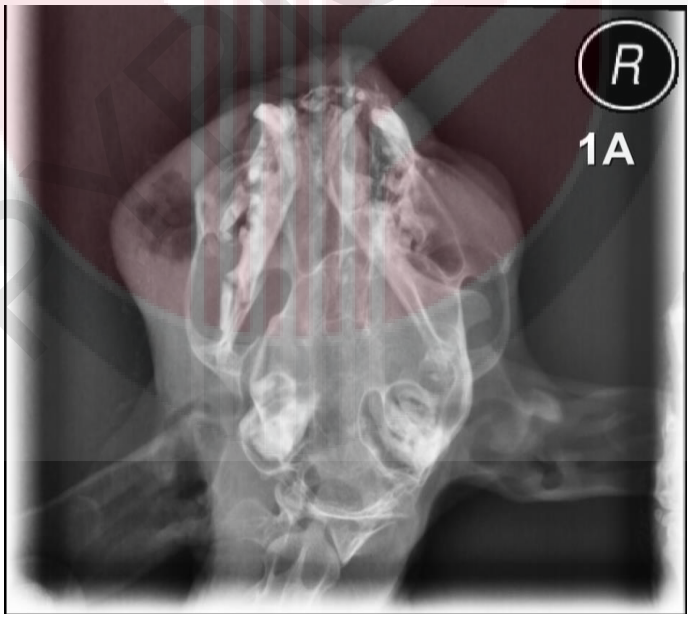

Figure 1.5: Nasal septum separation

Figure 1.6: Cerclage wire placement for mandibular symphyseal separation

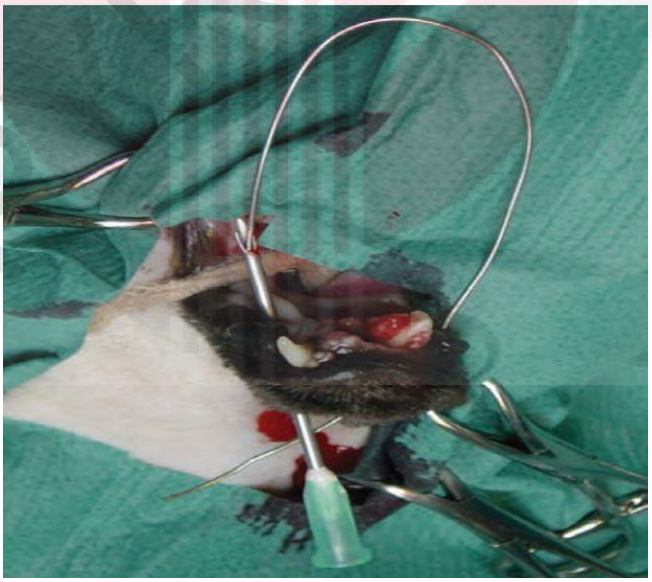

Figure 1.7: Types of trauma in cats and dogs

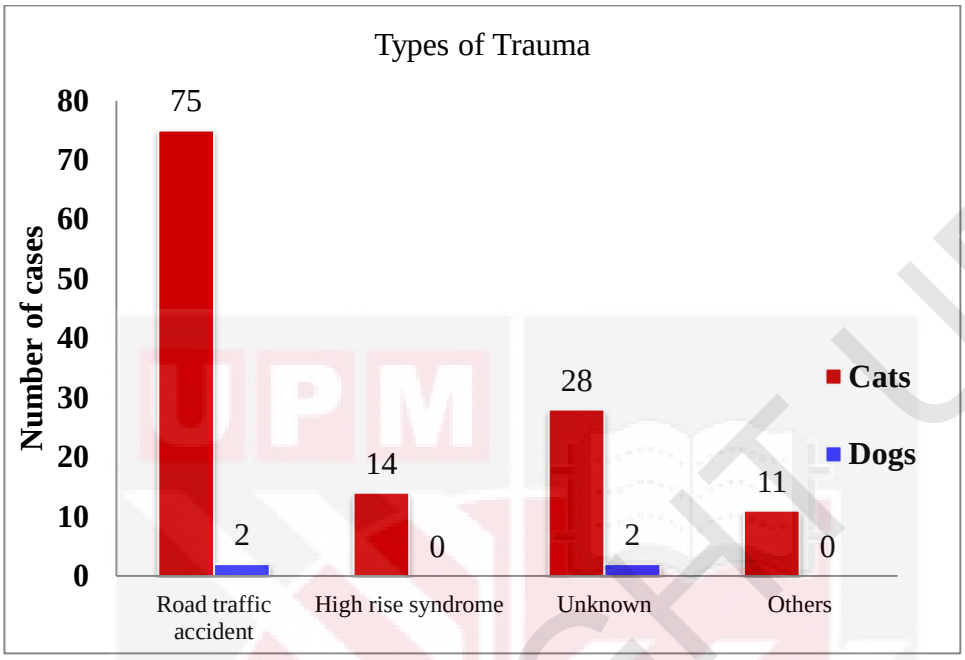

Figure 1.8: location of fractures in cats and dogs

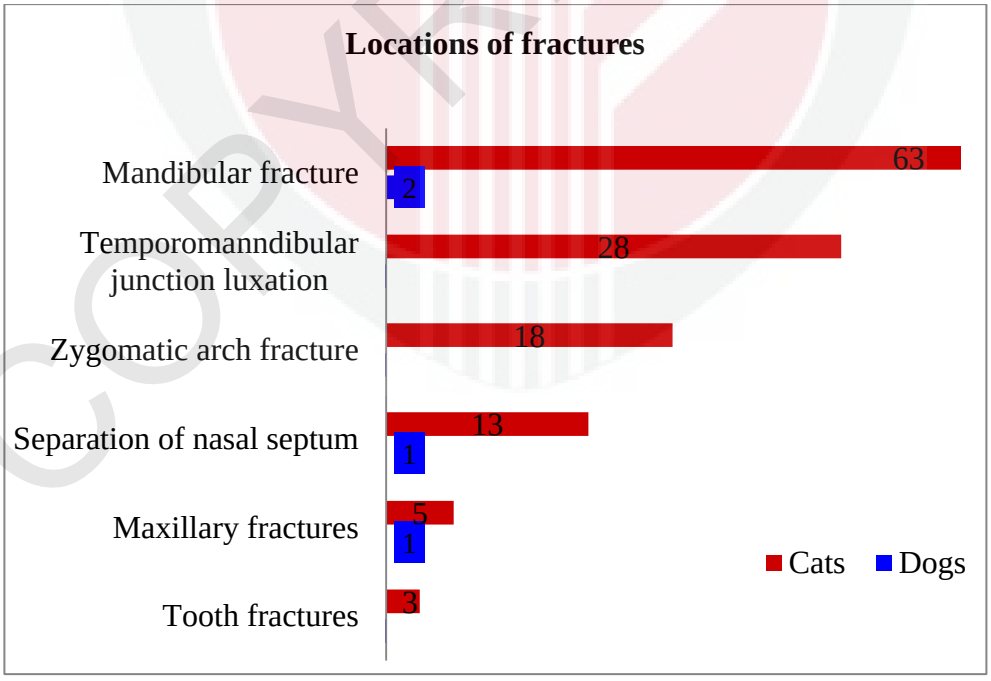

Figure 1.9: Types of fractures in cats and dogs

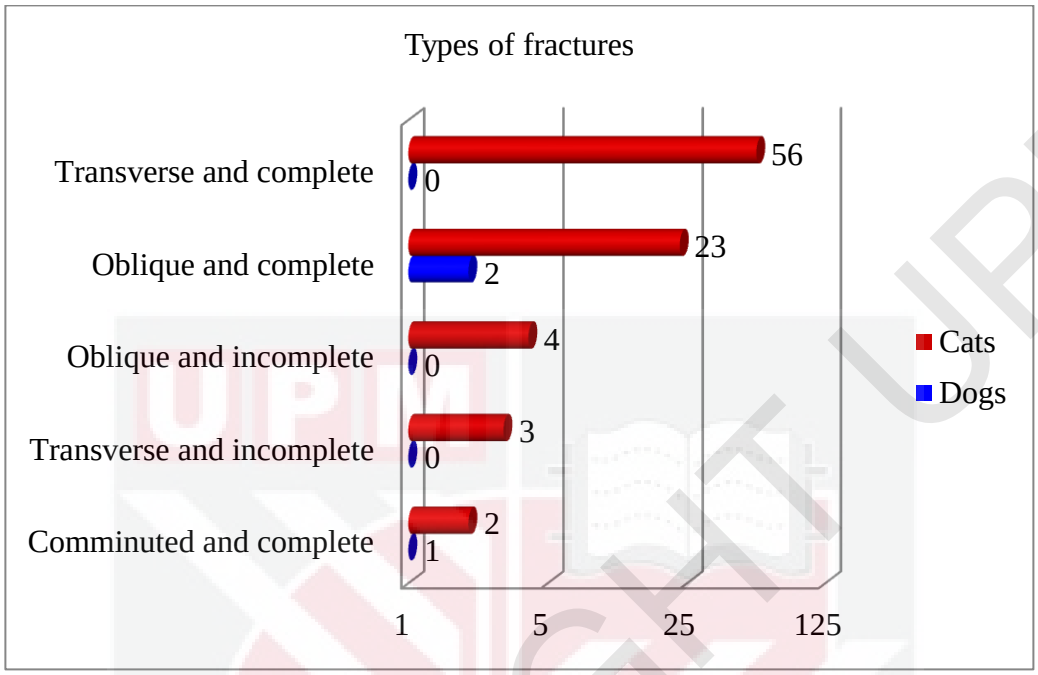

Figure 2.0: Treatment option for oral fractures in both cats and dogs

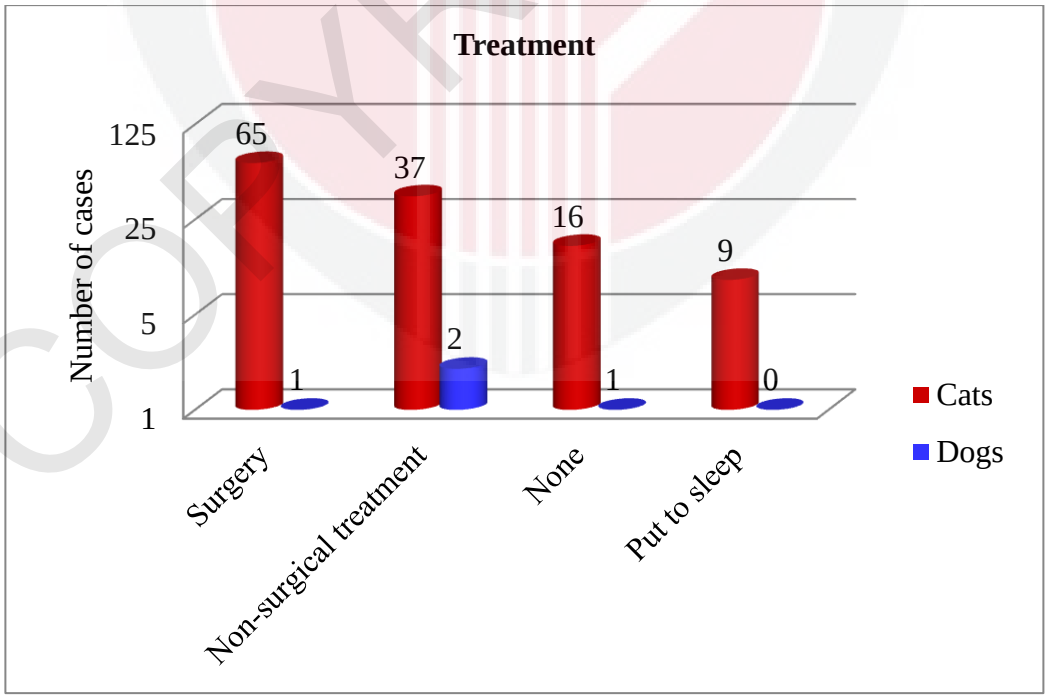

Table 1.1: Tabulated result

	Cats		Dogs	
	Junior	Adult	Junior	Adult
	N=55	N=73	N=1	N=3
Types of trauma				
Road traffic accident	33	42	0	2
High rise syndrome	8	6	0	0
Unknown	11	17	1	1
Others	3	8	0	0
Location of fractures				
Mandibular symphyseal separation	10	21	0	0
Mandibular canine region fracture	10	10	0	1
Mandibular body fracture	3	0	0	0
Mandibular premolar region fracture	2	0	0	1
Mandibular molar region fracture	0	2	0	0
Ramus fracture	2	1	0	0
Maxillary incisor region fracture	2	3	1	0
Separation of nasal septum	6	7	0	1
Temporomandibular junction luxation	11	17	0	0
Zygomatic arch fracture	8	10	0	0
Tooth fracture	1	2	0	0
Types of fractures				
Transverse and complete	10	13	0	1
Oblique and complete	13	9	1	0
Comminuted and complete	1	1	0	1
Transverse and incomplete	2	1	0	1
Oblique and incomplete	2	2	0	0
Comminuted and incomplete	0	0	0	0
Treatment approach				
Surgery	29	32	0	1
Non-surgical treatment	17	24	0	2
None	6	11	1	0
Put to sleep	3	6	0	0
Surgical approach				
Cerclage wire	17	19	0	1
Dental extraction	4	0	0	0
Cerclage wire and tape muzzle	0	4	0	0
Cerclage wire and dental extraction	1	3	0	0

Cerclage wire and closed reduction	2	0	0	0
Maxillectomy	0	1	0	0
External skeletal fixation type 1 and dental extraction	3	0	0	0
External skeletal fixation type 2	0	2	0	0
External skeletal fixation and cerclage wire and dental extraction	0	3	0	0
Complication				
Malocclusion	4	4	0	0
Unable open mouth completely	0	0	0	0
Suture breakdown	1	3	0	0
Movable mandible	0	0	0	0
Mandible misalignment	0	0	0	0
Unable close mouth	3	4	0	0
Response to treatment				
Good	28	35	1	1
Poor	12	11	0	0
Died	3	16	0	0